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BUREAU OF ENTOMOLOGY—BULLETIN No. 94, Part I.
L. O. HOWARD, Entomologist and Chief of Bureau.

INSECTS INJURIOUS TO FORESTS AND FOREST PRODUCTS.

DAMAGE TO CHESTNUT TELEPHONE AND TELEGRAPH POLES BY WOOD-BORING INSECTS.

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badly injured by borers and that these borers were abundant. On March 8, 1907, he collected larvæ from chestnut telephone poles at Pennsboro, W. Va. These were determined to be the larvæ of the chestnut telephone-pole borer.

The writer on October 3, 1909, inspected some chestnut telegraph poles which had been standing for about twelve years on New York avenue, in Washington, D. C. The poles had been taken down under orders from the city authorities, which necessitated the placing of wires in conduits under ground, and they had been lying in piles for about a month before they were inspected. The chestnut telephone-pole borer had been working in the base of the poles, and white ants, or termites, were associated with them. Twelve out of the 103 poles examined had been damaged, some more seriously than others.

On October 15, 1909, Mr. H. E. Hopkins sent a reply to a request by Dr. A. D. Hopkins for further information regarding insect damage to poles in West Virginia. He stated that in one line built twelve years ago (40 miles long, 36 chestnut poles to the mile, poles 20 to 40 feet long and 5 to 12 inches in diameter at the top) approximately 600 poles had been rotted off at the top of the ground, and inspection showed that 95 per cent of the damage was directly or indirectly due to insects. Other lines in this division were reported to be in about the same condition. It was later determined that most of the insect damage was the work of the chestnut telephone-pole borer.

Dr. A. D. Hopkins states in a recent comprehensive bulletin [a] that "construction timbers in bridges and like structures, railroad ties, telephone and telegraph poles, mine props, fence posts, etc., are sometimes seriously injured by wood-boring larvæ, termites, black ants, carpenter bees, and powder-post beetles, and sometimes reduced in efficiency from 10 to 100 per cent." Thus, while it has been known that almost all classes of forest products that are set in the ground are seriously injured by wood-boring insects, the problem of insect damage to standing poles, posts, and other timbers has never been made the subject of a special investigation.

In May, 1910, this study was assigned to the writer, and, in addition to a study of the insects involved, investigations in cooperation with telephone and telegraph companies have been conducted in the District of Columbia, Maryland, Virginia, Pennsylvania, New Jersey, and New York. Through the courtesy of the Western Union Telegraph Company several telegraph lines were inspected in July and August, 1910, in Virginia, where the poles were being reset or replaced. Here the butts of over 200 poles set under different conditions of site were thoroughly examined for insect damage, and sometimes the

[a] Insect Depredations in North American Forests. <Bul. 58, Part V, Bureau of Entomology, U. S. Department of Agriculture, p. 67, 1909.

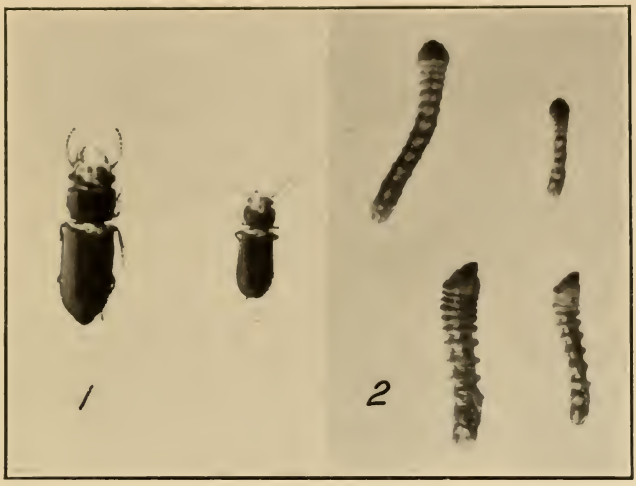

FIG. 1.—THE CHESTNUT TELEPHONE-POLE BORER (PARANDRA BRUNNEA): MALE AND FEMALE BEETLES. FIG. 2.—THE CHESTNUT TELEPHONE-POLE BORER: YOUNG LARVÆ, DORSAL AND LATERAL VIEWS. FIG. 1, SLIGHTLY ENLARGED; FIG. 2, TWICE NATURAL SIZE. (ORIGINAL.)

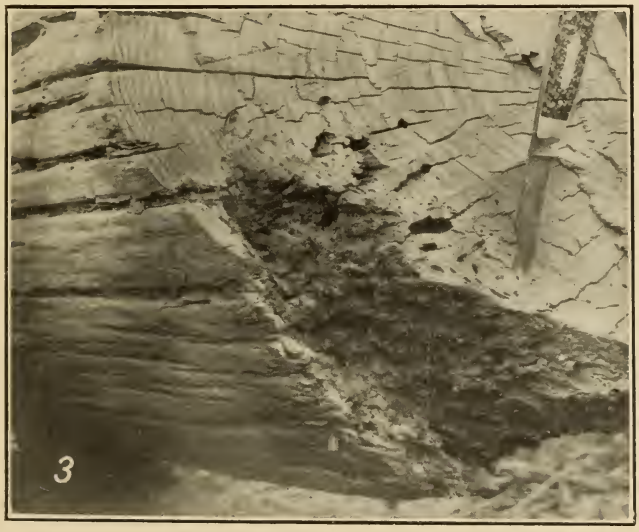

FIG. 3.—DAMAGE TO AN UNTREATED CHESTNUT TELEGRAPH POLE NEAR SURFACE OF GROUND BY THE CHESTNUT TELEPHONE-POLE BORER. (ORIGINAL.)

entire pole was split open. In one line 10 to 12 years old (approximately 30 chestnut poles per mile, 25 feet long, about 6 inches diameter at the top, 10 inches at the base, and apparently of second quality), between Petersburg and Crewe, Va.—the poles had already been reset once, east of Wilson, Va.—serious damage by the chestnut telephone-pole borer rendered from 15 to 20 per cent of the poles unserviceable. After the present second resetting it was estimated that the poles can not last more than four or five years longer. West of Wilson the poles were naturally in much worse condition, and many were broken off and only held up by the wires on the sounder poles. In another line examined, between Portsmouth and Boykins, Va. (poles 30 feet long and apparently of second quality), serious damage by this borer averaged about 10 or 15 per cent, and between Boykins, Va., and Weldon, N. C., according to a linesman, 50 per cent of the poles are badly decayed near the surface of the ground. Much of this damage, however, is due to fungous heart rot. According to a statement by the foreman of a resetting crew, between Asheville, N. C., and Spartanburg, S. C., hundreds of chestnut poles were badly decayed in the 67 miles of line reset, and were only held up by the wires. The line was 15 years old. There was serious damage by "wood lice" (termites) and also by "white wood worms."

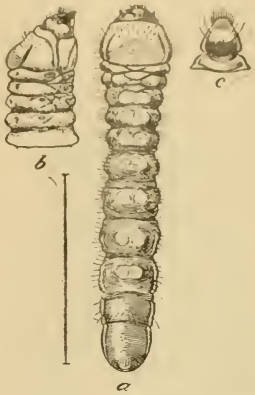

FIG. 1.—The chestnut telephone-pole borer (*Parandra brunnea*): Full-grown larva. (About twice natural size. (Original.)

THE CHESTNUT TELEPHONE-POLE BORER.

(*Parandra brunnea* Fab.)

CHARACTER OF THE INSECT.

The chestnut telephone-pole borer is a creamy white, elongate, stout, cylindrical, so-called "round-headed" grub or "wood worm" (fig. 1), which hatches from an egg deposited by an elongate, flattened, shiny, mahogany brown, winged beetle from two-fifths to four-fifths of an inch in length. (Plate I, fig. 1; text fig. 2.) The eggs are probably deposited from August to October in shallow natural depressions or crevices on the exterior of the pole near the surface of the ground; often the young larvæ enter the heartwood through knots. The young borers (Plate I, fig. 2) hatching therefrom eat out broad shallow galleries running longitudinally in the sapwood, then enter the heartwood, the mines being gradually enlarged as the larvæ develop. As they proceed, the larvæ closely pack the fine excreted boring dust behind them. This débris, which is characteristic of

their work, is reddish to dunnish yellow in color and has a claylike consistency. The mines eventually end in a broad chamber, the entrance to which is plugged up by the excelsior-like fibers of wood chiseled out by the strong mandibles of the larva. Here the resting stage (fig. 3), or pupa, is formed, and in this chamber the perfect adult spends considerable time before emerging. Often all stages from very young larvæ only about one-fourth inch long to full-grown larvæ over 1 inch long, pupæ, and adults in all stages to maturity are present in the same pole. Adults have been found flying from July to September. As yet the seasonal history of this borer has not been completely worked out.

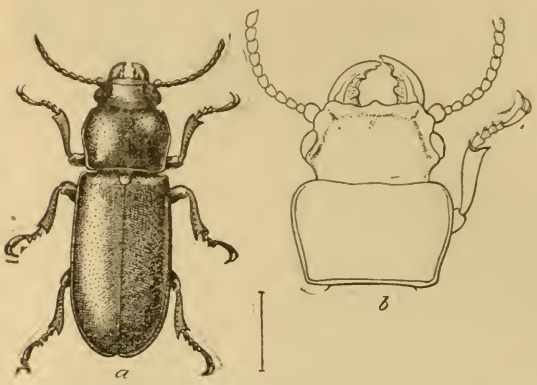

FIG. 2.—The chestnut telephone-pole borer: Female beetle, three and one-half times natural size. Head and pronotum of male beetle. (Original).

DISTRIBUTION.

This insect is very widely distributed, ranging from Ontario, Canada, to Texas, eastward to the Atlantic coast, and westward to Arizona and southern California. It is common throughout the natural range of the chestnut—and in this connection it should be observed that most of the chestnut poles are purchased from local timber-land owners.

CHARACTER OF THE INJURY.

The injury to the poles consists in large mines in the wood near the line of contact of the pole with the ground, necessitating the frequent resetting or even the replacement of the damaged poles. These irregular galleries of the grub (Plate II, fig. 1) run both horizontally and longitudinally throughout the heartwood, and are sometimes 7 inches long, but vary with the individuals, which show great differences in size. The borers usually work in the outer layers of the wood at the base of the pole for a distance of from 2 to 3 feet below, and sometimes from 1 to 2 feet above the line of contact of the pole with the surface of the ground. The greatest damage is to that area just below and just above the surface of the ground (Plate I, fig. 3); here the conditions of air and moisture are most favorable. Often the entire butt up to a distance of from 4 to 6 feet and higher, according to the depth of setting, is mined. The numerous galleries, often very close together, completely honeycomb the wood in a zone

FIG. 1.

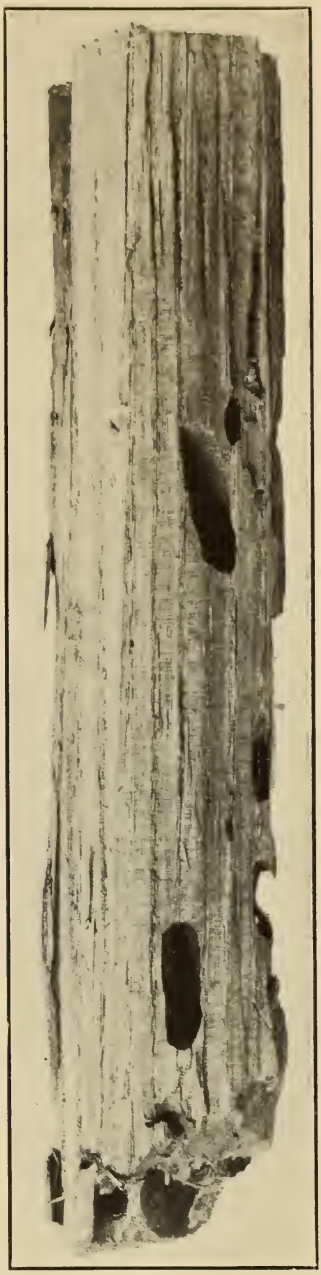

FIG. 2.

WORK OF THE CHESTNUT TELEPHONE-POLE BORER.

Fig. 1.—Gallery of the chestnut telephone-pole borer, showing pupal chamber with the entrance plugged with excelsior-like wood fibers; work near base of pole, below ground. Fig. 2.—Mines of the chestnut telephone-pole borer near surface of ground. Natural size. (Original.)

3 to 4 inches in from the exterior of the poles; this so weakens the poles that they break off close to the surface of the ground. The basal 2 feet is usually sound. Even if the damage is not serious enough to cause the poles to break off under strain, they are likely to go down during any storm, and thus put the wire service out of commission; such damaged poles are a serious menace along the right of way of railroads. The beetle will attack poles that are perfectly sound, but evidently prefers to work where the wood shows signs of incipient decay; it will not work in wood that is "sobby" (wet rot), or in very "doty" (punky) wood. It has not yet been determined just how soon the borers usually enter the poles after they have been set in the ground. However, poles that had been standing only four or five years contained larvæ and adults of this borer in the heartwood, and poles that had been set in the ground for only two years contained young larvæ in the outer layers of the wood.

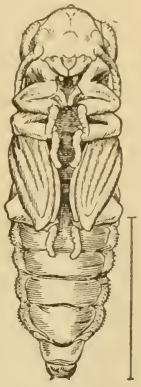

FIG. 3.—The chestnut telephone-pole borer: Pupa. Slightly more than twice natural size. (Original.)

Poles that appear sound on the exterior may have the entire basal interior riddled, and the work of the borers is not noticed until the poles break off. If merely isolated poles are injured, the poles that are broken off are held up by the wires and can be detected by the fact that they lean over, but if several adjacent poles are affected, especially where there is any unusual strain, that portion of the line is very likely to go down. The presence of the borers in injurious numbers can be determined only by removing the earth from about the base of the pole; the exit holes of the borer are found near the line of contact with the soil. Often large, coarse borings of wood fiber project from the exit holes. Sometimes old dead parent adults are found on the exterior of the poles underground. During August the young adults may be found in shallow depressions on the exterior of poles below the ground surface.

IMPORTANCE OF THE PROBLEM.

The subject of the relation of insects to the rapid decay of chestnut poles has not been thoroughly investigated in the past, but now that the supply is becoming scarcer it is especially important to know what are the various primary causes of the deterioration of these poles, hitherto described under the vague term "decay." Although the chestnut telephone-pole borer has not hitherto been considered an insect of any economic importance, and has been described in entomological literature as only living under bark, principally of pine, or

in the decomposing wood of various species of deciduous and coniferous trees, the evidence is abundant that breeding in the bases of chestnut poles is not a newly acquired habit. It has also been determined that this beetle damages many species of living forest, fruit, and shade trees that have been previously injured by fire or other causes, and often leads to the destruction of trees that would otherwise recover from such wounds, and while not normally a primary enemy to trees, may thus become of more than secondary importance.

The damage by the chestnut telephone-pole borer is especially serious in consideration of the fact that in many parts of its range the chestnut is threatened with extinction as a tree species on account of the very severe ravages of the combined attack of an insect [a] and a fungous disease. Further unnecessary drain upon the supply of chestnut timber should be avoided by protecting that already in use and thus prolonging its length of service.

EXTENT OF DAMAGE AND LOSS.

As more than one-fourth of the 3,500,000 round poles exceeding 20 feet in length used annually by telephone, telegraph, and other electric companies are chestnut (Kellogg, 1909),[b] and as this borer has seriously damaged as high as 10 to 40 per cent, varying with conditions of site, of the chestnut poles which have been set in the ground for from ten to twelve years in lines in North Carolina, Virginia, West Virginia, Maryland, and the District of Columbia, it is evident that this insect is an important factor in decreasing the normal length of service of the poles.[c] In lines from twelve to fifteen years old the damage is much greater, and at the end of this number of years of service any line in which poles of this species are set has to be practically renewed. According to a statement in Forest Service Bulletin 78 (Sherfesee, 1909), "approximately 4 per cent, or 5,908 feet board measure of the 147,720 feet board measure of standing poles annually requiring replacement in the United States, is destroyed by insects." If only chestnut poles be considered, at least 10 per cent of the poles reset or replaced are injured by insects.

FAVORABLE AND UNFAVORABLE CONDITIONS FOR DESTRUCTIVE WORK.

The damage is apparently greatest and the borers are most abundant where the poles are set in high or level dry ground under good conditions of drainage. Such sites are the crests of railroad cuts through low hills, slopes of "fills," and in cultivated or other fields. Where the poles are in wet sites there is usually but little injury by

[a] *Agrilus bilineatus* Web.

[b] See list of publications, page 11.

[c] The average life of a chestnut pole is eight to ten years (Sherfesee and Weiss, 1909).

wood-boring insects except to that portion near the surface of the ground. Conditions of drainage are more important than different soil combinations, and the condition of the soil is more important than its composition; *i. e.*, where the soil is hard packed there is apparently less damage than where it is loose. The quality and condition of the poles before setting is a very important factor to consider before arriving at any conclusions as to the relative longevity of poles under various conditions of site. Green (unseasoned) or imperfectly seasoned poles are less durable than those thoroughly seasoned. Poles that are defective [a] before setting, as they very often are (i. e., showing evidence of incipient decay), and poles that have the heartwood mined by the chestnut timber worm, [b] the work of which is very abundant, will, of course, decay much more rapidly than poles that are in an absolutely sound condition. The galleries of the chestnut timber worm afford an entrance to the spores of wood-destroying fungi, and thus greatly accelerate decay. White mycelium compactly filled these galleries throughout many standing poles, thus clearly proving that these mines aid greatly in enabling the fungous heart rot more rapidly and completely to penetrate the entire heartwood of the poles. If the injury by both wood-boring beetles and wood-destroying fungi (between which there is a varying interrelation) be considered, then in several lines from ten to twelve years old in North Carolina, Virginia, and West Virginia at least 50 per cent of the poles are either rendered unserviceable or their length of service is much shortened.

ASSOCIATED WOOD-BORING INSECTS.

It is not to be concluded that this wood-boring beetle is the only insect that injures standing chestnut poles. Indeed, the most common injury is by the "wood lice" or white ants.[c] In lines from ten to twelve years old these insects have seriously damaged as high as 15 per cent of the poles, and their work is often present, at least superficially, in as high as 75 per cent of the poles under all conditions of site. However, the damage is usually to the outer layers of the wood, where it is moist or there is incipient decay, and is more superficial and localized than that of the chestnut telephone-pole borer. Nevertheless, white ants often completely honeycomb the sound heartwood of poles, especially at the base. They work both in sound wood, "doty" (dry rot) wood, and "sobby" (wet rot) wood. Sometimes a large channel runs up through the core of the heart

[a] Often this evidence is the old galleries of the destructive two-lined chestnut borer (*Agrilus bilineatus* Web.), showing that the tree must have been dead before it was cut for a pole, and hence is more likely to be defective throughout the interior; in other instances heart rot is clearly present.

[b] *Lymexylon sericeum* Harr.

[c] Identified by Mr. Theodore Pergande of this Bureau as *Termes flavipes* Kollar.

and the sides are plastered with clay, forming a hollow tube with several longitudinal galleries. Their work often extends from 2 to 4 feet above the surface of the ground. They leave the outer shell of the wood intact and work up through the longitudinal weathering checks, covering the exterior of the pole with earth to exclude the light. White ants will damage poles that have been set in the ground only two years. Evidently they enter the pole from below the surface of the ground. The habits and characteristics of these peculiar and interesting insects have been thoroughly discussed in Circular No. 50 of this Bureau by Mr. C. L. Marlatt.

A giant round-headed borer [a] is sometimes found in the poles, usually in association with the chestnut telephone-pole borer. In poles where the wood is sound this borer apparently works as a rule only in the outer layers of the wood, the galleries running longitudinally through the heart below the surface of the ground. In poles where there is decay it will completely honeycomb the heartwood near the surface of the ground.

In several poles where the wood was "doty" a large Scarabæid [b] which has before been found in decayed oak railroad ties was present and caused the poles to break off sooner than they otherwise would. The irregular galleries of the grub completely honeycomb the decayed heartwood near or just below the surface.

A flat-headed borer [c] and wireworms [d] were found in galleries locally in the more or less decayed heartwood of several poles. A large black carpenter ant [e] does some damage to sound poles set in dry ground through woodland. This ant often widens the longitudinal weathering checks and thus accelerates decay. A small black ant [f] was very numerous in many poles, but its work is usually confined to the outer layers of the wood. The work is often throughout "doty" poles. Injury by this ant is not primary, but it also widens weathering checks, enlarges other defects, and induces more rapid decay.

PREVENTION OF THE INJURY.

Doctor Hopkins makes the following statement in a recent bulletin:[g]

> Insect damage to poles, posts, and similar products can be prevented to a greater or less extent by the preservative treatments which have been tested and recommended by the Forest Service for the prevention of decay. These should be applied

[a] *Prionus* sp.

[b] Identified by Mr. E. A. Schwarz, of this Bureau, as *Polymœchus brevipes* Lec.

[c] Identified by Mr. H. E. Burke, of this Bureau, as *Buprestis rufipes* Oliv.

[d] Species of the family Elateridæ. The large larvæ of *Alaus* sp. were especially injurious.

[e] Identified by Mr. Theodore Pergande as *Camponotus pennsylvanicus* Mayr.

[f] Identified by Mr. Theodore Pergande as *Cremastogaster lineolata* Say.

[g] Insect Depredations in North American Forests. <Bul. 58, Part V, Bur. Ent., U. S. Dept. Agr., p. 84, 1909.

before the material is utilized for the purposes intended, or, if it be attacked after it has been utilized, further damage can be checked to a certain extent by the use of the same substances.

It is often of prime importance to prevent injury from wood-boring insects, for the reason that such injuries contribute to more rapid decay. Therefore anything that will prevent insect injury, either before or after the utilization of such products, will contribute to the prevention of premature deterioration and decay.

Through the courtesy of the American Telephone and Telegraph Company and the Forest Service, about 40 chestnut poles set in a test line near Dover, N. J., were inspected by the writer on July 15, 1910, in company with engineers of the telephone company and Mr. H. F. Weiss, Assistant Director, Forest Products Laboratory, Forest Service, to determine the relative merits of various methods of preventing damage by wood-boring insects to the bases of poles. In this line, which is eight years old, variously treated poles alternated with untreated poles in order that each chemical preservative and method of treatment might be given an absolutely fair test under the same conditions of site. The poles were 30 feet long, 7 inches in diameter at the top, and 33 inches in circumference 6 feet from the base. In this inspection the earth was removed (to a depth of about 1 foot) from the base of the pole, and then the pole was chopped into to determine the rate of decay. This method of inspection for insect damage is not very satisfactory. The various methods experimented with in this test line were brush treatments with a patented carbolineum preservative and spirittine, charring the butt, setting the pole in sand, and setting it in small broken stone. It was found that, although these methods may temporarily check the inroads of wood-boring insects, they will not keep the insects out of the poles. The most serious damage to the poles in this line was by white ants. Other insect damage was by a large black carpenter ant[a] and the larvæ of a round-headed borer.[b]

An inspection was made, between September 6 and 14, 1910, of the bases of over 400 chestnut poles set in a similar test line near Warren, Pa., and Falconer, N. Y. These poles were treated by the creosote "open-tank" method of impregnation, and brush treatments of creosote, wood creosote, creolin, two different carbolineum preservatives, and tar; they had been set in the ground for a period of five years. All these treatments, except the brush treatments with creolin and tar, were efficient in preventing the attacks of wood-boring insects, at least for a five-year period, in this northern climate. There was but little damage by insects to the poles in this test line. The most common injury to the untreated poles was by the large black carpenter ants which widen the longitudinal weathering checks, and hence induce more rapid decay. The work of the chestnut tele-

[a] *Camponotus pennsylvanicus* Mayr.

[b] *Prionus* sp.

phone-pole borer was found in several poles, and this beetle was evidently just beginning to attack these poles. There was some damage by a round-headed borer.[a] No white ants or termites were present, and this is evidently too far north for these destructive borers. A report by inspectors of the American Telephone and Telegraph Company and the Forest Service on the remainder of the poles in this test line (between Jamestown and Buffalo, N. Y.) not personally inspected by the writer, showed that these conclusions can be applied to all the poles in the line with the exception that there was superficial injury by small black ants to two poles treated by brush treatments of carbolineum avenarius and to two treated with wood creosote; also, as the inspection progressed, injury by the chestnut telephone-pole borer became more abundant and serious, and the borers seemed to be established in the poles. The poles treated by the creosote "open-tank" method of impregnation and by brush treatments with creosote and with "S. P. F." carbolineum remained uninjured.

Methods of treating poles superficially by brushing with various preservatives have proved to be temporarily efficient in keeping wood-boring insects out, if the work is thoroughly done and not only the butt, but also the base, is treated. If the pole is not thoroughly brushed, insects enter through the untreated or imperfectly treated portions, especially through weathering checks and knots. Where the base is left untreated, insects, especially white ants or termites, enter the pole from below ground and, avoiding the treated portions, come right up through the pole.

The few poles of southern yellow pine in a line near Bartley, N. J., inspected on July 15, 1910, which had been impregnated with creosote by the Bethell cylinder-pressure process, 12 pounds of oil to the cubic foot, and had been set in the ground since February, 1903, were apparently absolutely free from signs of decay or damage by wood-boring insects. In another line, running between Norfolk, Va., and Washington, D. C., the few poles (12 years old, of squared—with the sapwood cut away—southern yellow pine) inspected on August 10, 1910, near Portsmouth, Va., which had been impregnated with creosote by the Bethell cylinder-pressure process, were also apparently absolutely sound.

Thus, it is evident that impregnating the poles with creosote by some standard process (either the open-tank or the cylinder-pressure processes) will keep wood-boring insects out and preserve the poles for a much longer period than they would last untreated. In the open-tank method only the area most subject to the attacks of wood-boring insects and deterioration in general (i. e., the basal 8 feet) is treated, while by the cylinder-pressure processes the entire pole is impregnated. Alternating less susceptible juniper (red cedar)[b] poles

[a] *Priorus* sp.

[b] *Juniperus virginiana.*

or pine poles thoroughly impregnated by some standard process in the line with the chestnut poles would be a safeguard in holding up an old line where the damage is found to be serious on resetting.

A list of some available publications on wood preservation is appended.

PUBLICATIONS ON WOOD PRESERVATION AND STATISTICS ON POLES.

1903. Von Schrenk, H.—Seasoning of timber. <Bul. 41, Forest Service, U. S. Dept. Agr.

1906. Grinnell, H.—Prolonging the life of telephone poles. <Yearbook U. S. Dept. Agr. for 1905, Extract No. 395.

1907. Crawford, C. G.—The open-tank method for the treatment of timber. <Cir. 101, Forest Service, U. S. Dept. Agr.

1907. Crawford, C. G.—Brush and tank pole treatments. <Cir. 104, Forest Service, U. S. Dept. Agr.

1907. Grinnell, H.—Seasoning of telephone and telegraph poles. <Cir. 103, Forest Service, U. S. Dept. Agr.

1908. Sherfesee, W. F.—A primer of wood preservation. <Cir. 139, Forest Service, U. S. Dept. Agr.

1908. Weiss, H. F.—Progress in chestnut pole preservation. <Cir. 147, Forest Service, U. S. Dept. Agr.

1909. Sherfesee, W. F.—Wood preservation in the United States. <Bul. 78, Forest Service, U. S. Dept. Agr., pp. 24, 25, Table I.

1909. Sherfesee and Weiss.—Wood preservation. <Rep. Natl. Conserv. Com., vol. 2, p. 663.

1909. Kellogg, R. S.—The timber supply of the United States. <Cir. 166, Forest Service, U. S. Dept. Agr., pp. 20–21.

1910. Willis, C. P.—The preservative treatment of farm timbers. <Farmers' Bul. 387, U. S. Dept. Agr.

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